

Appendix E-7

Operation Instructions to Start DTC in Design Work

1. Control flow of whole design operations including DTC
2. Proposal of DTC, weight reduction etc. theme/idea proposal sheet and management procedure
3. DTC trade study procedure (Form to be used)

Document No. DTC-001	Title Control flow of all design operations including DTC	Approved by	Controlled by	Compiled by
		Person in Charge of Agreed Cost Control		

1. Control Policy

- (1) All items related to a development are compiled into a WBS table. Control with superior visibility is to be conducted primarily in a visibility room.
- (2) Operations are established at each level (individual, group, party, team) with a structured control to be implemented.
- (3) Proposition of theme and problems, as well as a schedule follow-up, are handled primarily through internal control within each team. However, when it is a matter of concern for all teams, the theme or problem should be solved immediately through a design meeting.

2. Significance of Control Methods that Use a Development/Design WBS

- (1) A Development/Design WBS is a structured table of items that defines the whole system of project AAAA and indicates the mutual relationship between items by including all those operational items required in a development.
The WBS is to be used as a tool for controlling and eliminating oversight, retreat, duplication, etc., in operations.
These are aimed at securing execution of the centralization of information and report system and at clarifying responsible sections.
- (2) There are two types of Development/Design WBS, a MIL-STD-881A (Parent-Child model) and a PMD model. Both models should be used, combining their features.

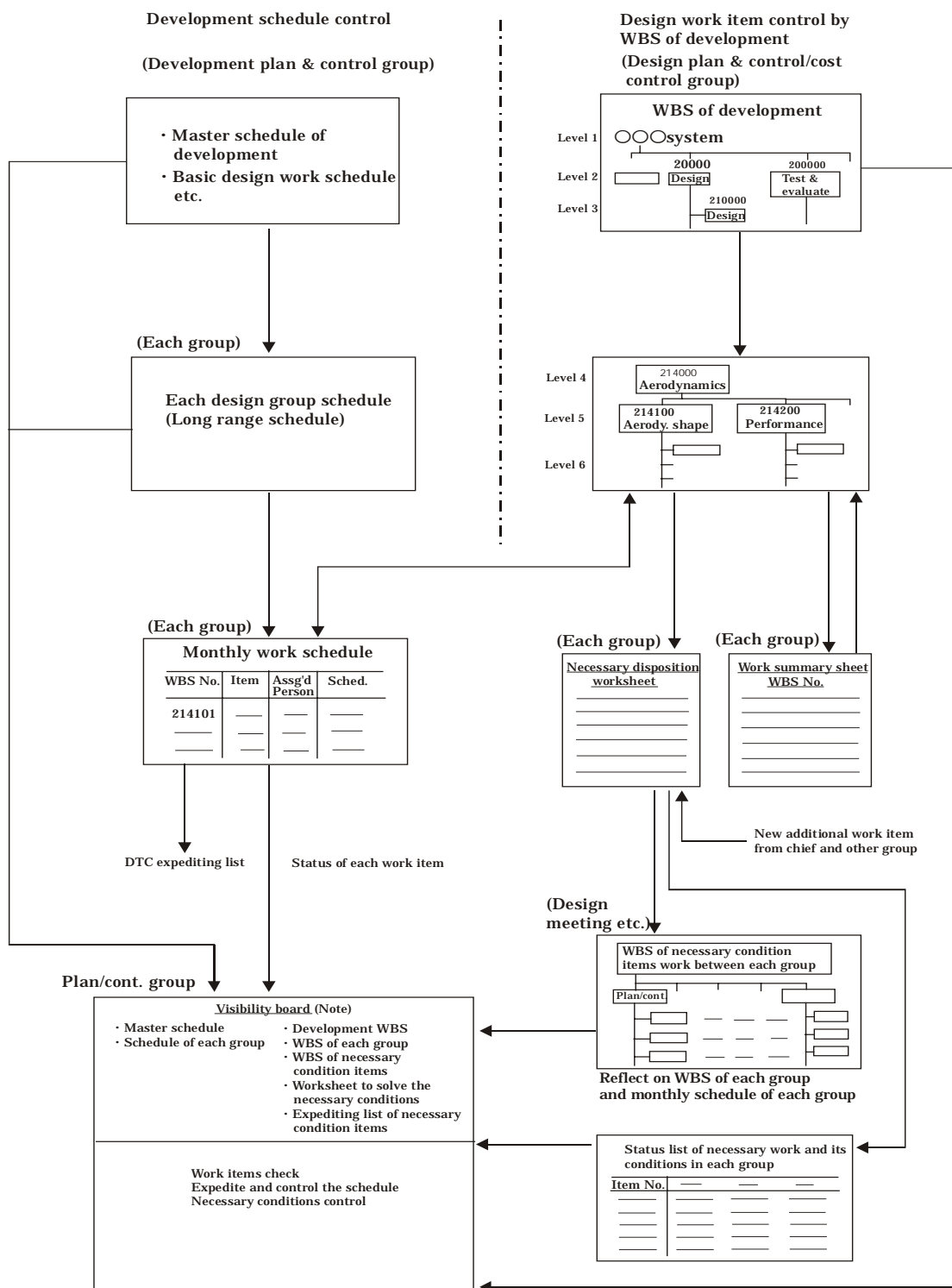
3. Preconditions for Implementing Control

- (1) A team leader is responsible for reporting on the implementation and operational status of a Development/Design WBS at the team level.
- (2) The operation of each team and the items to be examined will be controlled by the WBS. Through this, transmission of information will be adjusted. For this purpose, a planning sheet, a work summary sheet, a necessary disposition worksheet, and other related forms, will be unified.
- (3) A DTC trade study expedition sheet will be compiled and controlled for each operational item (which is important in cost control).

4. Control Procedure (flow of control is shown in Fig. 1)

- (1) A WBS will be deployed in detail and implemented by each team, following the establishing the Base line WBS by WBS officer
- (2) Each team will compile a work summary sheet for each operation with a “monthly work schedule” to follow.
- (3) A team will compile a “necessary disposition worksheet” of items that need to be disposed of following a major change in an operational schedule, and for new items to be taken care of. Other teams, on the other hand, will identify and compile lists of those problems that might affect them. Each team will adjust schedules mutually and conduct operations jointly, as well as assign operations to each of the other teams.
- (4) Upon consideration of the operational procedure, status of each operation, an overall schedule sheet (Master schedule of development and basic design work schedule) and WBS should be completed.

Fig. 1 Management flow of total design work



(Note) Visibility board means the visibility board in meeting room in which every people easily discuss anything by looking its visibility board.

No.	Title	Approved by	Controlled by	Compiled by
DTC-5	DTC weight reduction theme/idea proposal sheet and its disposition			

1. Purpose

This procedure for DTC/weight reduction theme/idea proposal and management establishes to achieve target figures.

2. Related Documents

- (1) DTC-001 “Control Flow of Whole Design Operations Including DTC”
- (2) DTC-002 “Procedure to Select DTC/LCC Trade Theme During Design Work” Refer to Table 7.2-11 in related document (4)
- (3) DTC-003 “Procedure for Implementing Design Meeting”
- (4) Advanced Project Management Methodology;
"Thinking and its Procedure for DTCN and DTC"

3. Concerned Sections

- (1) Each design team
- (2) Sections involved in design, production control, material and quality control
- (3) Cost Control Team (Secretary)

4. Outline of Proposal and Its Disposition

4.1 Proposals from Design Team

(1) Each design team (including Cost Control Team) will compile a WBS of items for study according to the related document (1) and register them in order to achieve target figures for cost, weight, etc.

Based on the WBS table, a detailed sub-division is made regarding study according to the related document (2) that will be integrated into the design work schedule.

Those items considered to be appropriate themes/ideas for study, but not suitable for inclusion in the WBS table for procedural reasons, should be documented in an attached "DTC Weight Reduction Theme/Idea Proposal Sheet" to be submitted to the Cost Control Team.

The disposition procedure after this is as follows.

4.2 Proposals from the Manufacturing Planning, Material, Quality Control Sections of Each Company

The Cost Control Team acts as a Secretary and handles the following procedure.

(1) Proposal:

Necessary information will be documented in the attached "DTC Weight Reduction Theme/Idea Proposal Sheet" and will be submitted to the Cost Control Team.

(2) Registration:

- A. The Cost Control Team will confirm the written information and register, and organize it in the registration book. Proposals related to weight reduction are to be distributed to the Engineering Control Team.
- B. The section which receives proposals from outside companies should write down the registration number on the upper right side of the theme/idea proposal sheet and take charge of the sheets.

(3) Study of contents:

The Cost Control Team and Engineering Control Team will study the contents of the proposals, achieve coordination with related sections, as necessary, and establish a list of items for study to be proposed at a design meeting.

(4) Proposition at design meeting:

The Cost Control Team and Engineering Control Team will compile a list of study items of themes/ideas, which are up for proposition at a design meeting, on a "DTC Trade Study Plan/Expediting List." Items for design study will be adopted following discussions at a design meeting.

(5) Documenting each design team's study items:

Adopted items will be documented in each design team's WBS, following the procedure outlined on the related documents (1) and (2). A design meeting will examine the study. Items classified as DTC/LCC themes during a meeting will be placed under expedition control based on a "DTC Trade Study Plan/Expediting List".

(6) Reporting to proponents:

The Cost Control Team and Engineering Control Team will report the design meeting's decisions and the progress of procedure in design study to proponents.

DTC-5 Fig. 1 DTC weight reduction theme/idea proposal sheet

Action

DTC, Weight, R&M, Quality Theme/idea proposal sheet			Reg. No.				
Theme *		Company		Proposer		Date	
WBS	Nomenclature or name	Phase to examin	Basic design	Plan drawing	Mfg. drawing	Review	Prod. Dwg.
		
1 . Theme (draft)/idea (Sketch as necessary)							
2 . What is the purpose or expected effect? *							
3 . What conditions must be satisfied to implement proposal?							
4 . What led you to create this proposal? *							
Result of investigation and/or examination			Theme accepted				
			Idea accepted				
			Pending(up to)				
			Not adopted				
Note 1 . No need to complete all columns. (* marked columns must be filled in) 2 . Do not hesitate to propose something even if it is already being considered or has been proposed. 3 . Proposal must be forwarded to (). 4. This proposal will be processed according to “DTC proposal and investigation/examination practice”.			Follow-up				
			.				
			.				

No.	Title	Approved by	Controlled by	Compiled by
DTC-10	Outline of DTC trade study (format to be used)			

1. Purpose:

To decide the procedure for selecting an optimum plan through a DTC trade study of multiple design plans

2. Related Documents

- (1) DTC-4 "Procedure for DTC Theme/Idea Abstraction"
- (2) DTC-5 "Procedure for DTC Weight Reduction Theme/Idea Proposal Sheet and management procedure"
- (3) DTC-6 "Procedure for DTC Theme Selection"
- (4) DTC-11 "Procedure for Making and Maintaining Cost Reduction Sheet"
- (5) DTC-12 "Procedure for Items not included Target Cost after DTC Study"

3. References

- (1) Advanced Project Management Methodology;
"Thinking and its Procedure for DTCN and DTC" (ASII Publishing Co.)

4. Concerned Sections

Design, manufacturing planning, production, quality control (S&PA: Safety and Product Assurance), material, business administration, sales, DTC Secretary

5. Contents

- (1) Procedure for making plans for comparison
- (2) Estimate procedure
- (3) Procedure for comparison for decision-making
Appendix 1: Procedure for filling DTC worksheet

6. Cycle of Operations by DTC Trade Worksheet

The operation cycle shown on Fig. 1 should be repeated before drawing, until the appropriate prospects are established.

7. Operation to Make Comparable Plans

(1) The Design Section will create more than two or three plans, which emphasize high effectiveness and efficiency in materializing design requirements, for comparison. Simplified design sketches and the characteristics of the design plans will be draw up in the DTC worksheet.

In order to create effective and efficient design plans for comparison, the FBS technique will be used.

(Note) 1. To create design plans, efforts should be made to create all possible minimum cost plans, minimum weight plans, maximum reliability and maintainability (R&M) plans and other extreme plans as shown in Fig. 1. A design plan should be made on the supposition that the right plan exists in an area surrounded by these three types of plans.

(Note) 2. When design plans have to be made, an "Idea matrix column " in the DTC worksheet should be used.

(Note) 3. In such cases, persons in charge of production technology, production, material, etc., will participate in the examination of the plans from the widest possible idea matrix.

(2) The Design Section documents those items necessary for making an estimate in an estimate worksheet (Estimate Price/Cost Breakdown Structure Table) and attaches it to a DTC trade worksheet. In those cases where Engineering information is necessary for estimating the cost differences of each plan, the information may not fit into a DTC worksheet alone.

8. Estimating

(1) The Design Section will make an estimate based on such factors as cost, weight, reliability and maintainability, etc., with the cooperation of related sections.

a. The DTC Secretary will make cost estimates with the support of the Manufacturing Planning and Material Sections.

b. If there are factors which should be appraised in the selection of a design plan besides cost, weight, reliability and maintainability, etc., (such as a Life Cycle List, or LCC), an estimate should also be made on them. (For the calculation of an LCC, a LCC estimate form should be used.)

c. If it is difficult to understand the difference between each plan in terms of reliability and maintainability, they may be appraised using the priority method.

(2) The Design Section will check for risks in the schedule, development, etc., of each design plan. If there are risks, they should be written down on the DTC worksheet.

9. Procedure for Comparison with the Decision-making Process

(1) Based on the estimate results, the Design Section will document the ranking of design plans in a space on the DTC trade worksheet and identify other data in a Weight/Cost Trade Study Graph to make a comparative appraisal. If a conclusion cannot be reached using a ranking of estimates, a weighing point appraisal method should be adopted to make a comparison.

(The weighing point appraisal method will be referred to in Chapter 4.3 of reference (1). "Evaluation and Structuring Method by Reasonable Feeling".

(2) The weighing-point appraisal method will be implemented as follows, using the appropriate space on the DTC worksheet.

- a. First, factors for estimate appraisal and their weight coefficients in the weighted-point appraisal method are decided after obtaining the agreement of those people involved in plan selection.
- b. Points are then set for each appraisal factor of the plan based on the ranking of estimated figures.
- c. The points are multiplied using the weighing point appraisal method and each plan's total is calculated.
- d. The ranking is decided by total points. If the ranking is questionable, a comprehensive adjustment is made with the agreement of the people concerned.

(3) The Chief of the Design Section will select a final plan for implementation through a comparative appraisal obtained using the above procedure. The Chief will write in a personal comment and outline the conditions for the selection in the appropriate spaces.

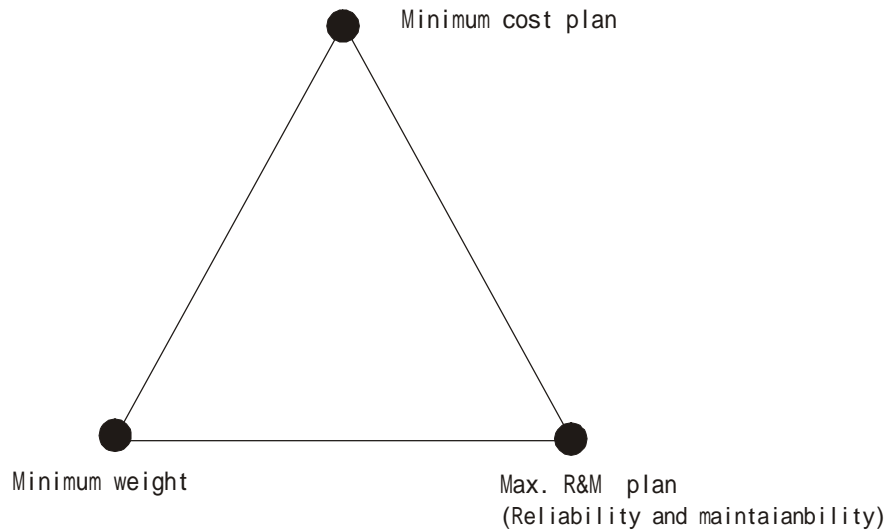
(4) The Design Section Chief will explain to the Chief Engineer and obtain approval from the Chief with the agreement of the DTC Secretary and Design Section Chief.

If necessary, agreement of the Manufacturing Planning and Material Section should be obtained.*

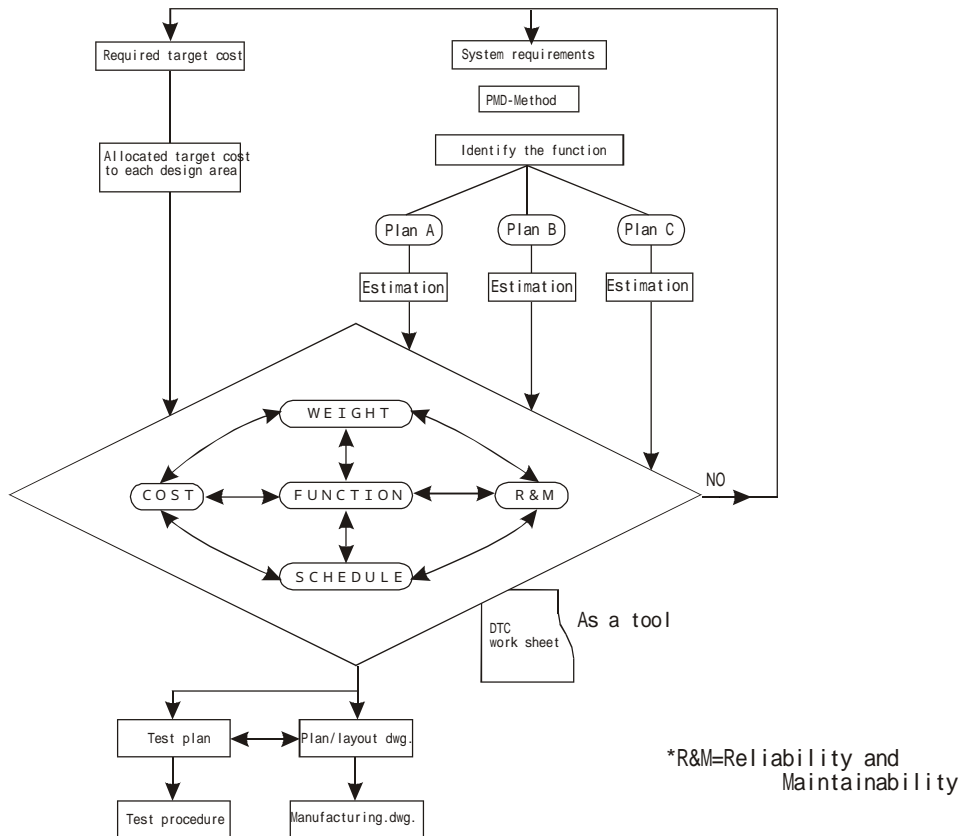
*For example, in selecting purchase equipment, the agreement of the Material Section becomes necessary.

Fig. 1 Creation of design idea and work cycle for Design-to-Cost

Most appropriate idea exists inside of triangle of three maximum feasible ideas or plans.



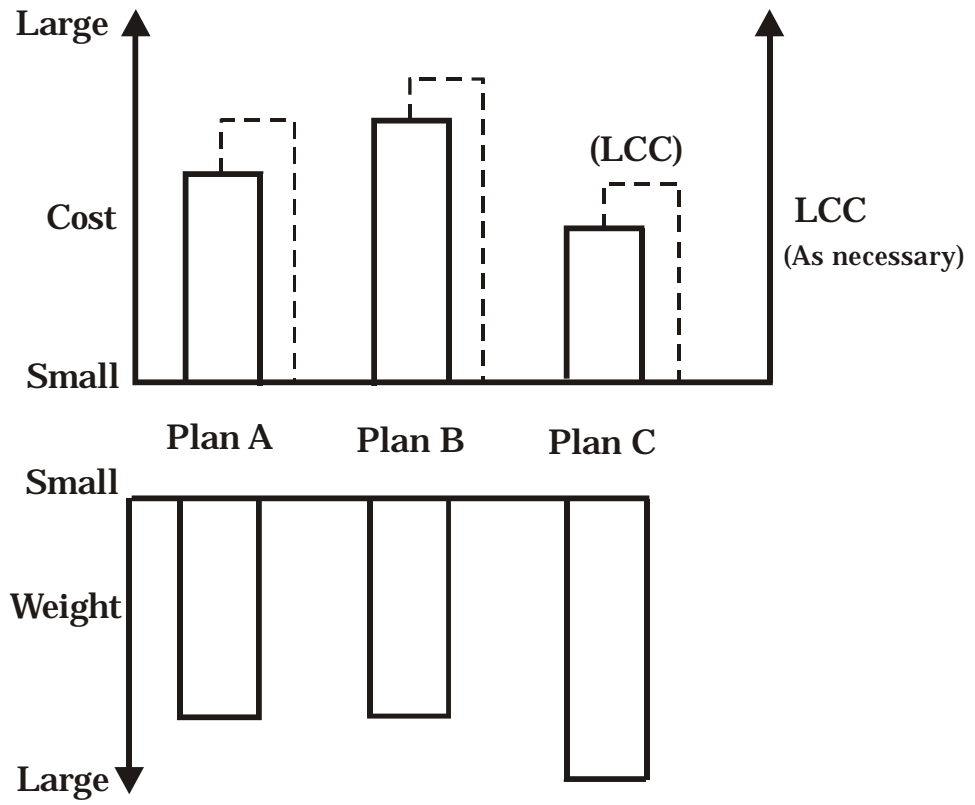
Design work cycle by DTC/LCC trade worksheet with ideas comparison



There is also a few case one idea creation flow design method .

Fig. 2 Example of trade study graph

Example of trade study graph

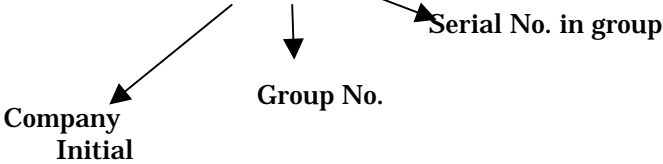


DC-10 DTC Trade worksheet to be filled in

DTC worksheet

DTC WORK SHEET	Sch.Plan	R'qt Check	Basic Func.	Ideas creation	Ideas comparison	Evaluation	Judge	Agree			Approval			Person in charge	Revision			Page							
								Leader	Cost Gp.	Chief	Planning	Purchasing	Drafted		Reviewed	Approved									
								Act.Date																	
WBS Name			WBS No.			Theme			Basic Function																
Target cost	Idea matrix					Plan A	Title	Plan B	Title	Plan C	Title	Sign column													
	Type	Components	Materials	Mfg.ways	Sub-con etc.																				
Cost	M/H						(Sketch)		(Sketch)		(Sketch)		Drafted												
	Material																		Checked						
	Total																		Approved						
Weight	Kg												Agreed												
Reliability																									
Maintainability																									
(Other Requirement)						Explanation of contents and its distinctive character																			
<u>Notice on estimations</u> The estimated value of differences only is acceptable.						Cost Estimation (Average evaluation cost per XXX A/C)		Mfg.M/H (H)	Material	Mfg.M/H (H)	Material	Mfg.M/H (H)	Material												
Trade-off graph weight & cost LCC						Eval.Item	Wt.Coef.	Estimation	Ranking	Point	Wt.*Point	Estimation	Ranking	Point	Wt.*Point	Estimation	Ranking	Point	Wt.*Point	(30)					
						Cost		\$				\$				\$									
						Weight	(21)	(16) Kg	(22)	(23)	(24)	Kg			Kg						Checked				
						Total			(25)												Agreed				
						Schedule & Comment							(27)												
						Evaluation, Comment							(28)												
						Total ranking							(29)												
						Selected Idea							(31)												
						General comment & Conditions of selection						(32)													
						Sign							Chief Eng.	Sub-Chief	DTC suport										
												(39)	(38)	(37)											

Appendix 1. How to fill in DTC worksheet

No.	Contents to be filled in	Person responsible
	WBS name of trade study objective.(e.g. wing box)	Designer
	WBS No. of above	Designer
	Theme of trade study. (e.g., breakdown style of fuselage and wing)	Designer
	Design group name	Designer
	<p>Worksheet control No. (List this number in registration list controlled by Cost Control Group)</p> <p>Example : D T C X - 4 - 0 0 1</p> 	Designer
	Write target cost (If not applicable, leave it blank.)	Designer
	Design requirements and caution (If not applicable, leave it blank.)	Designer
	<ol style="list-style-type: none"> 1 . Write the keyword of the basic function when necessary. In order to identify the keyword of the basic function, use the PMD method. 2 . Do not write this when selecting equipment. 	Designer
	<ol style="list-style-type: none"> 1 . Write the possible ideas to satisfy the basic function. 2 . Use NM-Method when having difficulty coming up with ideas or expanding the scope of the idea. See NM-Method in Appendix A. 	Designer
	1 . Draw sketches of the maximum feasible and comparative	Designer

	<p>designs using elements in row .</p> <p>2 . Make an effort to draw two or more possible comparative plans even though only one plan can be considered.</p> <p>3 . It is recommended that the comparative plan include: minimum cost plan, minimum resource plan, and optimized plan.</p> <p>4 . The comparative plan must show the necessary information and data, if only in rough.</p> <p>5 . Show the comparative characteristics of the comparative plans.</p>	
	<p>After finishing , give the characteristics of each plan a name that is easy to understand.</p>	<p>Designer</p>
	<p>Have creator, checker and group leader sign/initial the worksheet.</p>	<p>Designer</p>
	<p>Conditions of estimating.</p>	<p>Designer</p>
	<p>Manufacturing, material and amortizing costs for each idea or plan. (It is acceptable to show only the difference in estimated cost of the comparative plans.)</p>	<p>Cost Control Group (Teamed with manuf. Plan & purch. grp.)</p>
	<p>Total estimated cost to compare. (")</p>	<p>As in</p>
	<p>Estimated weight to compare. (")</p>	<p>Designer</p>
	<p>Write numerical parameter of reliability. (If necessary) e.g.; MTBF (Mean Time Between Failure) If it is difficult to estimate this numerical value, it is acceptable to use the result of comparison by the priority method.</p>	<p>Designer</p>
	<p>Write the numerical parameter of maintainability. (If necessary) e.g.; MTTR (Mean Time To Repair). If it is difficult to estimate, it is acceptable to use the result of comparison by the priority method.</p>	<p>Designer</p>
	<p>Fill in this column if there is a necessary comparative factor which greatly affects decisions other than cost, or R&M. e.g.; LCC, performance, deployment.</p>	<p>Designer</p>

	<p>The numerical estimate of column .</p> <p>If it is difficult to estimate this numerically, do not use the priority method.</p>	Designer
②1	<p>Compare the comparative plans using estimated value and then prioritize each plan.</p> <p>If it is easy to get the result by priority method, it is not necessary to fill in columns ②1 ~ ②4 for the weighting factor method.</p>	Designer
②2	<p>Fill in the evaluation number of the comparative plan for each evaluation factor.</p>	Designer
②3	<p>Fill in the weighting number for each evaluation factor.</p>	Designer
②4	<p>Fill in the result of ②2 × ②3 of each plan.</p>	Designer
②5	<p>Total the priority numbers or numerical results of the weighted evaluation.</p>	Designer
②6	<p>Visualize the comparison using a bar graph of the estimated values of each plan.</p> <p>When an LCC (lifecycle cost) comparison is made, show an LCC estimate bar graph. (See Fig. 2 for an example of a comparison bar graph)</p>	Designer
②7	<p>Write the schedule risk, development risk or problem as necessary.</p>	Designer
②8	<p>Write a comment about each plan.</p>	Designer
②9	<p>Fill in the total priority number of integrally compared results.</p>	Designer
③0	<p>Have designer and checker sign or initial.</p>	Designer

- ③ Write the pre-selected plan as a draft of the final selection.